Guidance for Professionals

State of Wisconsin
Department of Health and Family Services
Division of Public Health

Indoor Fungal Infestations and Mycotoxicity

Guidance for Medical and Public Health Professionals

Key messages for health care providers:

- Mold particles are complex mixtures of biological chemicals, some having allergenic or toxigenic properties. Although it is scientifically necessary to understand the pharmacological effect of fungal compounds in isolation, exposure occurs in concert.
- In theory, there are four ways in which molds could produce or aggravate human illness: 1) Type I immune reactions, including allergic rhinitis or asthma; 2) Type III immune reactions, such as hypersensitivity pneumonitis and allergic aspergillosis; 3) Toxic reactions to mold products (mycotoxins); and 4) Irritation to mucous membranes through mold-produced volatile organic compounds (VOCs).
- There are no *confirmed* cases of mycotoxicity, via inhalational exposure, in residential or office settings. In contrast, toxic effects following the ingestion of moldy food by livestock and people are well documented. Allergy is the health effect normally ascribed to inhaled molds. A few cases have correlated*, but not confirmed,* pulmonary hemosiderosis and pulmonary pneumonitis to the presence of mold in the home. Documented cases of non-allergic health effects to humans following inhalation of molds have occurred in occupational settings, primarily in the handling of grain and animal feed. In these and other occupations involving the generation of biological particulates, there is a risk of chronic exposure to inhaled mycotoxins greater than that expected in residential or office settings.

Evaluating a health effect from mold requires both a medical diagnosis and an environmental assessment. The presence of mold in a building does not in itself constitute a health threat. The control of indoor mold infestation, by cleaning and resolving moisture problems, is usually sufficient to protect public health. In some cases, a health-based assessment of the indoor environment and occupants may be preferred to verify the degree and extent of the problem. Such a determination is critical in deciding upon a potentially disruptive and expensive course of action in a large commercial or public building. The health assessment should include:

Potential for exposure: An evaluation of health effects from mold exposure should be made within the context of molds prevalent in the environment, including the quantity and profile of fungi present in bulk and air samples. Airborne mold, measured by colony-forming units (CFUs), is normally more abundant outdoors than indoors during the growing season, while the representation of mold species is normally proportional indoors and out. In the case of indoor infestation, the relative representation of mold species changes. For example, Cooley, *et al*.,[1] based on a study of 48 schools, report that in outdoor air in mild temperate regions of North America, five fungal genera predominate: *Cladosporium* (81.5%), *Penicillium* (5.2%), *Chrysoporium* (4.9%), *Alternaria* (2.8%), and *Aspergillus* (1.1%). In outdoor air samples *Cladosporium* were about 24-fold more predominant than the next-most common mold, *Penicillium*. Indoors, *Cladosporium* predominated over *Penicillium* in similar proportion, although *total* CFU counts were 3-4 fold lower. Inside mold complaint buildings, *Penicillium sp*. were much more common, *Cladosporium* being only about 3-fold more predominant. Furthermore, in 20 of 48 schools with indoor air complaints, *Penicillium sp*. were dominant, being 4.7-fold more abundant in air than *Cladosporium*. Such changes in species representation are diagnostic of indoor mold infestation, but not of actual exposure. Similarly, changes in species profiles do not necessarily indicate an imminent health threat.

Medical diagnosis, to determine if health complaints are consistent with mold exposure: Health complaints may be related to other indoor air quality problems, such as other sources of allergens, carbon monoxide, or volatile organic compounds. Exposure to these contaminants must also be considered and ruled out with respect to the patient's symptoms/condition.

Verification of exposure: Strict criteria, such as those suggested in the sidebar, should be adopted in order to accurately establish links between the presence of molds having potential health effects and occupant's health complaints. These criteria should include evidence of exposure ("abundant" allergen in indoor air; serum IgE to same allergen), and symptoms of allergy following clinical exposure to the allergen.

Recommendations

- The presence of mold in a building does not in itself constitute a health threat. Therefore, the remediation of mold and water damage in buildings should be based on non-clinical factors, unless otherwise indicated medically. Usually, controlling water leaks and humidity in the building is the main public health recommendation.
- The perception of indoor mold as a pervasive public health threat often leads to costly environmental assessments, monitoring, and remediation. To avoid unwarranted remedies, there is a need for improved communication and education between public health, the medical profession, environmental professionals, elected officials, and the public. The key messages are: the ubiquitous distribution of fungi in the environment, the types and amount of fungi normally found indoors, the risks posed by the molds detected, and options for confronting the problem.

Evaluating the role of molds in "sick building syndrome."

Bernstein has suggested an approach to suspected building-related illness that includes:[2]

(1) a thorough history (duration and nature of symptoms, home environmental and workplace history, past medical history, family history);
(2) a physical exam;
(3) exclusion of more common infectious causes;
(4) phenotyping the patient as atopic versus non-atopic (skin testing to seasonal and perennial allergens including a mold panel [or corresponding serologic testing], spirometry pre-/post-bronchodilator);
(5) chest x-ray or high-resolution CT of chest (to determine if pulmonary findings consistent with hypersensitivity pneumonitis are present and require additional evaluation);
(6) supportive testing including serologic testing for specific IgG, IgE, or IgA to mold (including *Stachybotrys*), hypersensitivity pneumonitis screen (precipitating antibodies), and consideration of humoral and cell-mediated immune system evaluation;
(7) environmental assessment including walkthrough, air sampling, and measurement of known perennial allergens, irritants (VOCs and chemicals [nitrous dioxide, sulfur dioxide, ozone]), dew point, and mycotoxins;
(8) measurement of total symptom scores in and out of the environment;
(9) measurement of peak expiratory flow rates in and out of the environment event every 2-3 hours while awake and correlation with environmental exposure measurements; and
(10) consideration of specific provocation test (nasal challenge preferred to the more risky bronchoprovocation).

[1]Cooley DJ, Wong WC, Jumper CA, Straus DC. 1998. Correlation between the prevalence of certain fungi and sick building syndrome. *Occup. Env. Med. 55: 579*.

[2] Bernstein JA. The role of the allergist in building related illness. In: AAAAI (American Academy of Allergy, Asthma, and Immunology) 58th Annual Meeting. *Handouts on CD-ROM* [CD-ROM]. AAAAI; 2002.

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